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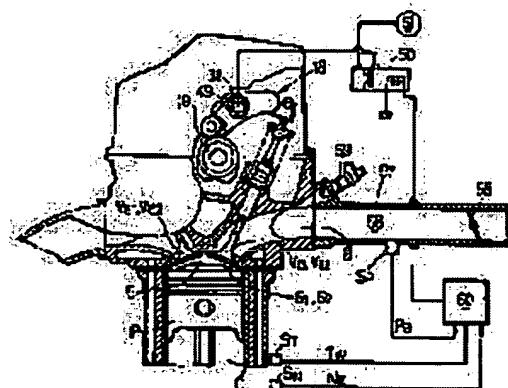
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(54) INTERNAL COMBUSTION ENGINE

(57)Abstract:

PURPOSE: To prevent smoke from being generated in cooling of an engine by extending the engine speed of an internal combustion engine or load by which the two valve operating range or the one valve operating range is set to the decreasing side when a pair of intake valves are positioned in the two valve operating range in the state where the temperature of the internal combustion engine is less than that at the time that warming-up is completed.

CONSTITUTION: A pair of intake valve ports 61, 62 opening to the ceiling surface of a combustion chamber 5 are communicated with a single intake opening end 8. Moreover both intake valve ports 61, 62 are individually opened and closed by a pair of intake valves V11, V12. And both intake valves V11, V12 are respectively switched by a valve system 18. In this case, the valve system 18 is controlled by a control means 60 through an electrically controlled valve 50 on the basis of respective detected signals by respective sensors SP, ST, SN for respectively detecting the driving state of the internal combustion engine. And the two valve operating range and the one valve operating range are respectively set on the basis of the engine speed and the engine load, and the engine speed or the engine load are extended to the decreasing side in the two valve operating range in the state where the engine temperature is less than that at the time that warming-up is completed.



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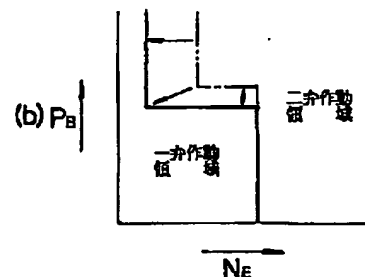
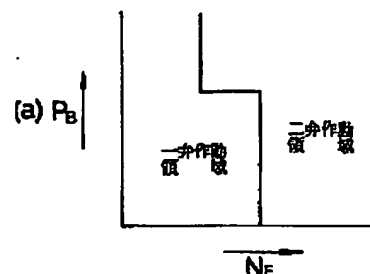
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(54) 【発明の名称】 内燃機関

(57) 【要約】

【目的】 一対の吸気弁をともに開閉作動せしめる状態と、両吸気弁の一方を開閉作動せしめるが他方を実質的に休止させる状態とを切換可能な動弁装置を備える内燃機関において、機関温度が暖機温度未満の低温状態でのスモーク発生を防止する。

【構成】 機関回転数および機関負荷の少なくとも一方に基づいて設定される二弁作動領域では両吸気弁をともに開閉作動せしめるが前記二弁作動領域以外の一弁作動領域では一方の吸気弁を開閉作動せしめるとともに他方の吸気弁を実質的に休止させるようにして動弁装置の作動が制御され、機関温度が暖機完了温度未満の状態での前記二弁作動領域は、暖機完了温度以上の状態に比べて前記機関回転数および機関負荷の少なくとも一方が低くなる側に拡大されて設定される。



【特許請求の範囲】

【請求項1】 一対の吸気弁 (V_{11} , V_{12}) をともに開閉作動せしめる状態と、両吸気弁 (V_{11} , V_{12}) の一方 (V_{11}) を開閉作動せしめるが他方 (V_{12}) を実質的に休止させる状態とを切換可能な動弁装置 (18) を備える内燃機関において、機関回転数および機関負荷の少なくとも一方に基づいて設定される二弁作動領域では両吸気弁 (V_{11} , V_{12}) をともに開閉作動せしめるが前記二弁作動領域以外の一弁作動領域では一方の吸気弁

(V_{11}) を開閉作動せしめるとともに他方の吸気弁 (V_{12}) を実質的に休止させるようにして動弁装置 (18) の作動を制御する制御手段 (60) を備え、機関温度が暖機完了温度未満の状態での前記二弁作動領域は、暖機完了温度以上の状態に比べて前記機関回転数および機関負荷の少なくとも一方が低くなる側に拡大されて設定されることを特徴とする内燃機関。

【請求項2】 前記動弁装置 (18) は、両吸気弁 (V_{11} , V_{12}) にそれぞれ個別に連動、連結されるロッカアーム (21, 23) を含む複数のロッカアーム (21, 22, 23) と、油圧解放に応じてそれらのロッカアーム (21, 22, 23) を連結して両吸気弁 (V_{11} , V_{12}) を開閉作動せしめる連結状態ならびに油圧作用に応じて前記ロッカアーム (21, 22, 23) の連結状態を解除して一方の吸気弁 (V_{11}) を開閉作動せしめるが他方の吸気弁 (V_{12}) を実質的に休止させる連結解除状態を切換可能な連結切換機構 (41) とを備えることを特徴とする請求項1記載の内燃機関。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、一対の吸気弁をともに開閉作動せしめる状態と、両吸気弁の一方を開閉作動せしめるが他方を実質的に休止させる状態とを切換可能な動弁装置を備える内燃機関に関する。

【0002】

【従来の技術】 従来、かかる内燃機関は、たとえば特開平4-203454号公報等により既に知られている。

【0003】

【発明が解決しようとする課題】 ところで、一対の吸気弁のうち一方を開閉作動せしめるが他方を実質的に休止させる状態にすると、機関本体の燃焼室内にスワール流を生じせしめて希薄燃焼を可能とすることができるが、該スワール流により燃焼室内での燃料濃度分布は半径方向外方側に向かうにつれて濃くなって所謂層状給気となり、機関温度が低温であるとき、特に機関負荷が高いときにはスモークが発生する。このスモークは排気臭がある等の官能的な不快感を与えるだけでなく、機関潤滑油の劣化、ピストンクレビス部のカーボンデポジットの形成およびピストンリングスティックの原因ともなり、機関耐久性を損なう要因にもなる。しかるに、上記従来のものでは、機関温度にかかわらず機関回転数および機関

負荷に基づいて二弁作動領域と一弁作動領域との境界値が一定に定められており、スモークの発生を防止することができない。

【0004】 本発明は、かかる事情に鑑みてなされたものであり、機関温度が暖機温度未満の低温状態でのスモーク発生を防止した内燃機関を提供することを目的とする。

【0005】

【課題を解決するための手段】 上記目的を達成するために、請求項1記載の発明は、一対の吸気弁をともに開閉作動せしめる状態と、両吸気弁の一方を開閉作動せしめるが他方を実質的に休止させる状態とを切換可能な動弁装置を備える内燃機関において、機関回転数および機関負荷の少なくとも一方に基づいて設定される二弁作動領域では両吸気弁をともに開閉作動せしめるが前記二弁作動領域以外の一弁作動領域では一方の吸気弁を開閉作動せしめるとともに他方の吸気弁を実質的に休止させるようにして動弁装置の作動を制御する制御手段を備え、機関温度が暖機完了温度未満の状態での前記二弁作動領域は、暖機完了温度以上の状態に比べて前記機関回転数および機関負荷の少なくとも一方が低くなる側に拡大されて設定されることを特徴とする。

【0006】 また請求項2記載の発明によれば、上記請求項1記載の発明の構成に加えて、動弁装置は、両吸気弁にそれぞれ個別に連動、連結される駆動ロッカアームを含む複数のロッカアームと、油圧解放に応じてそれらのロッカアームを連結して両吸気弁を開閉作動せしめる連結状態ならびに油圧作用に応じて前記ロッカアームの連結状態を解除して一方の吸気弁を開閉作動せしめるが他方の吸気弁を実質的に休止させる連結解除状態を切換可能な連結切換機構とを備える。

【0007】

【実施例】 以下、図面により本発明の一実施例について説明する。

【0008】 図1ないし図6は本発明の一実施例を示すものであり、図1は全体構成図、図2は動弁装置を示す拡大縦断面図、図3は図2の3-3線矢視図、図4は図3の4-4線断面図、図5は動弁装置の制御手順を示すフローチャート、図6は弁作動領域マップを示す図である。

【0009】 先ず図1および図2において、SOHC型多気筒内燃機関における機関本体の主要部を構成すべく、シリンダブロック1の上面にシリンダヘッド2が結合され、シリンダブロック1に設けられた複数のシリンダCにはピストンPが摺動可能にそれぞれ嵌合され、それらのピストンPの上面およびシリンダヘッド2間に燃焼室5がそれぞれ形成される。

【0010】 燃焼室5の天井面に開口するようにして、一対の吸気弁口6₁, 6₂と一対の排気弁口7₁, 7₂とがシリンダヘッド2に設けられており、両吸気弁口6

1, 6, は、シリンダヘッド2の一側面に開口する単一の吸気開口端8に、相互間に隔壁2aを挟んだ吸気ポート9, 9, を介して連なり、両排気弁口7, 7, は、シリンダヘッド2の他側面に開口する単一の排気開口端10に、相互間に隔壁2bを挟んだ排気ポート11, 11, を介して連なる。また両吸気弁口6, 6, を個別に開閉可能な一対の吸気弁 V_{11} , V_{12} は、シリンダヘッド2に配設された一対のガイド筒12にそれぞれ摺動可能に嵌合されており、各ガイド筒12から突出した各吸気弁 V_{11} , V_{12} の上端部にそれぞれ固定されたリテーナ13とシリンダヘッド2との間には各吸気弁 V_{11} , V_{12} を囲繞するコイル状の弁ばね14がそれぞれ介設され、それらの弁ばね14により各吸気弁 V_{11} , V_{12} は上方すなわち閉弁方向に付勢される。さらに両排気弁口7, 7, を個別に開閉可能な一対の排気弁 V_{21} , V_{22} は、シリンダヘッド2に配設された一対のガイド筒15にそれぞれ摺動可能に嵌合されており、各ガイド筒15から突出した各排気弁 V_{21} , V_{22} の上端部にそれぞれ固定されたリテーナ16とシリンダヘッド2の間には各排気弁 V_{21} , V_{22} を囲繞するコイル状の弁ばね17がそれぞれ介設され、それらの弁ばね17により各排気弁 V_{21} , V_{22} は上方すなわち閉弁方向に付勢される。

【0011】図3を併せて参照して、両吸気弁 V_{11} , V_{12} および両排気弁 V_{21} , V_{22} には動弁装置18が連結される。この動弁装置18は、図示しないクランクシャフトに1/2の減速比で連動、連結される単一のカムシャフト19と、カムシャフト19の回転運動を両吸気弁 V_{11} , V_{12} の開閉運動に変換するための第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23と、前記カムシャフト19の回転運動を両排気弁 V_{21} , V_{22} の開閉運動に変換するための第1および第2排気側ロッカアーム24, 25とを備える。

【0012】カムシャフト19は、シリンダヘッド2と、前記クランクシャフトの軸線に沿うシリンダ3の両側で該シリンダヘッド2上にそれぞれ結合されるホルダ26…とで、シリンダ3の軸線と直交する水平な軸線を有しながら回転自在に支承される。

【0013】図4において、カムシャフト19には、機関の低速運転に対応した形状の第1吸気側カム27と、機関の高速運転に対応した形状に形成されながら第1吸気側カム27の一侧に隣接配置される第2吸気側カム28と、第2吸気側カム28の一侧に隣接する隆起部29とが一体に設けられるとともに、第1吸気側カム27および隆起部29の両側に排気側カム30, 30が一体に設けられる。前記隆起部29は、機関の低負荷運転域で両吸気弁 V_{11} , V_{12} の一方 V_{11} を実質的に休止状態とすべく基本的にはカムシャフト19の軸線を中心とする円形の外面を有するように形成されるものであるが、第1および第2吸気側カム27, 28の高位部に対応する位置にはわずかに突出した突部が設けられている。しかも

カムシャフト19の軸線に沿う方向での該隆起部29の幅は比較的狭く設定される。

【0014】一方の吸気弁 V_{11} には第1駆動ロッカアーム21が連動、連結され、他方の吸気弁 V_{12} には第2駆動ロッカアーム23が連動、連結され、両吸気弁 V_{11} , V_{12} に対して自由となり得る自由ロッカアーム22が第1および第2駆動ロッカアーム21, 23間に配置される。而して第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23は、カムシャフト19の斜め上方位で該カムシャフト19と平行な軸線を有しながらホルダ26…に固定的に支持された吸気側ロッカシャフト31で揺動自在に支承される。また第1および第2排気側ロッカアーム24, 25は、両排気弁 V_{21} , V_{22} に個別に連動、連結されており、前記カムシャフト19の斜め上方位で前記吸気側ロッカシャフト31と平行にしてホルダ26…に固定的に支持された排気側ロッカシャフト32に揺動自在に支承される。

【0015】第1駆動ロッカアーム21の一端には第1吸気側カム27に転がり接触するローラ33が軸支され、第2駆動ロッカアーム23の一端には隆起部29に摺接する摺接部34が隆起部29に対応して幅を狭くしながら設けられ、自由ロッカアーム22には第2吸気側カム28に摺接するカムスリッパ35が設けられる。また両排気側ロッカアーム24, 25の一端には、カムシャフト19に設けられた排気側カム30, 30に転がり接触するローラ36がそれぞれ軸支される。

【0016】第1および第2駆動ロッカアーム21, 23の他端には、両吸気弁 V_{11} , V_{12} の上端に当接するタペットねじ37がそれぞれ進退自在に螺合されており、第1および第2駆動ロッカアーム21, 23の揺動動作に応じて各吸気弁 V_{11} , V_{12} が開閉動作することになる。また両排気側ロッカアーム24, 25の他端には、各排気弁 V_{21} , V_{22} の上端に当接するタペットねじ38がそれぞれ進退自在に螺合されており、両排気側ロッカアーム24, 25の揺動動作に応じて各排気弁 V_{21} , V_{22} が開閉動作することになる。

【0017】ところで、各ホルダ26…の上端間には支持板39が架設されており、この支持板39には、自由ロッカアーム22をカムシャフト19の第2吸気側カム28に摺接させる方向に弾発付勢するロストモーション機構40が配設される。

【0018】第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23には、それらのロッカアーム21~23の連結状態と、それらのロッカアーム21~23の連結解除状態とを、機関の運転状態に応じて切換可能な連結切換機構41が設けられる。

【0019】この連結切換機構41は、第1駆動ロッカアーム21に摺動可能に嵌合される切換ピストン42と、第1駆動ロッカアーム21および自由ロッカアーム22を連結可能な第1連結ピン43と、自由ロッカアーム

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ム22および第2駆動ロッカアーム23を連結可能な第2連結ピン44と、第2連結ピン44および第2駆動ロッカアーム23間に縮設されるばね45とを備える。

【0020】第1駆動ロッカアーム21には、自由ロッカアーム22側に開放した有底の第1ガイド穴46が吸気側ロッカシャフト31と平行に穿設されており、この第1ガイド穴46に切換ピストン42が滑動可能に嵌合され、切換ピストン42の一端と第1ガイド穴46の閉塞端との間に油圧室47が画成される。また第1駆動側ロッカアーム21には油圧室47に連通する連通路48が穿設され、吸気側ロッカシャフト31内には、第1駆動ロッカアーム21の揺動状態にかかわらず前記連通路48すなわち油圧室47に常時連通する油路49が設けられる。而して該油路49は、図1で示すように、連結切換用電磁制御弁50を介して油圧源51に接続される。

【0021】自由ロッカアーム22には、第1ガイド穴46に対応するガイド孔52が吸気側ロッカシャフト31と平行にして両側面間にわたって穿設されており、前記切換ピストン42の他端に一端が当接される第1連結ピン43がガイド孔52に滑動可能に嵌合される。

【0022】第2駆動ロッカアーム23には、前記ガイド孔52に対応する有底の第2ガイド穴53が自由ロッカアーム22側に開放するとともに自由ロッカアーム22側に臨む段部53aを有して吸気側ロッカシャフト31と平行に穿設されており、第1連結ピン43の他端に一端を当接させた有底円筒状の第2連結ピン44が前記段部53aに他端を当接させ得るようにして第2ガイド穴53に滑動可能に嵌合される。この第2連結ピン44は、その開口端を第2ガイド穴53の閉塞端側に向けて配置されるものであり、ばね45は、第2ガイド穴53の閉塞端および第2連結ピン44の閉塞端間に縮設される。しかも第2ガイド穴53の閉塞端には、空気および油抜き用の連通孔54が穿設される。

【0023】かかる連結切換機構41において、連結切換用電磁制御弁50により油圧室47に油圧を作用せしめると、切換ピストン42はばね45のばね力に抗して油圧室47の容積を増大する側に移動し、第2連結ピン44は段部53aに当接することにより移動端が規制される。この状態で、切換ピストン42および第1連結ピン43の当接面は第1駆動ロッカアーム21および自由ロッカアーム22間に対応する位置に在り、第1連結ピン43および第2連結ピン44の当接面は自由ロッカアーム22および第2駆動ロッカアーム23間に対応する位置に在る。したがって第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23は相互に相対角変位可能な状態にあり、カムシャフト19の回転作用により第1駆動ロッカアーム21は第1吸気側カム27によって揺動駆動され、一方の吸気弁 V_{11} は第1吸気側カム27の形状に応じたタイミングおよびリフト量で開閉作動する。また隆起部29に摺接した第2

駆動ロッカアーム23は実質的に休止状態となり、他方の吸気弁 V_{11} を実質的に休止させることができる。しかも吸気弁 V_{11} は完全に休止するのではなく、一方の吸気弁 V_{11} が開弁するときには開弁方向にわずかに作動するので、完全な閉弁状態を保ったときに生じる吸気弁 V_{11} の弁座への固着および燃料の滞留を防止することができる。さらに自由ロッカアーム22は第2吸気側カム28によって揺動駆動されるが、その揺動動作は第1および第2駆動ロッカアーム21、23に何らの影響も及ぼさない。また排気弁 V_{21} 、 V_{22} は排気側カム30、30の形状に応じたタイミングおよびリフト量で開閉作動する。

【0024】連結切換用電磁制御弁50により油圧室47の油圧を解放すると、第1ガイド穴46、ガイド孔52および第2ガイド穴53の軸線が一致したときに、ばね45のばね力により、第2連結ピン44は第1連結ピン43を押圧しながらガイド孔52に嵌合し、第1連結ピン43は切換ピストン42を押圧しながら第1ガイド穴46に嵌合する。而して切換ピストン42が第1ガイド穴46の閉塞端により移動を規制された状態で第1連結ピン43は第1駆動ロッカアーム21および自由ロッカアーム22を連結し、第2連結ピン44は自由ロッカアーム22および第2駆動ロッカアーム23を連結することになる。これにより、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23が連結状態となり、第2吸気側カム28によって揺動駆動される自由ロッカアーム22とともに第1および第2駆動ロッカアーム21、23が揺動し、両吸気弁 V_{11} 、 V_{12} はともに第2吸気側カム28の形状に応じたタイミングおよびリフト量で開閉作動せしめられる。また両排気側ロッカアーム24、25は、低負荷時と同様に排気側カム30、30の形状に応じたタイミングおよびリフト量で両排気弁 V_{21} 、 V_{22} を開閉作動せしめる。

【0025】すなわち、連結切換機構41は、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23を油圧解放に応じて連結して両吸気弁 V_{11} 、 V_{12} を開閉作動せしめる連結状態と、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23の連結状態を油圧作用に応じて解除して一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止させる連結解除状態とを切換可能に構成される。

【0026】再び図1において、吸気開口端8には、吸気通路56を形成する吸気管57が接続されており、該吸気通路56の途中にはスロットル弁58が介設される。また吸気管57におけるシリンダヘッド2側の端部には、吸気開口端8から両吸気弁口 6_1 、 6_2 に向けて燃料を噴射する燃料噴射弁59が取付けられる。

【0027】動弁装置18の作動状態を切換えるための

前記連結切換用電磁制御弁50の作動は、コンピュータから成る制御手段60により制御されるものであり、該制御手段60には、機関負荷を代表する指標としての吸気圧力 P_s を検出する吸気圧力センサ S_s 、機関回転数 N_e を検出する回転数センサ S_e で検出される機関回転数 N_e 、ならびに機関温度 T_e を検出する機関温度センサ S_t がそれぞれ接続される。

【0028】而して、連結切換用電磁制御弁50の作動すなわち動弁装置18の切換作動を制御するために、制御手段60で設定されている制御手順について図5を参照しながら説明すると、第1ステップS1および第2ステップS2で、吸気圧力 P_s 、機関回転数 N_e および機関温度 T_e を読み込んだ後の第3ステップS3では、機関温度 T_e が暖機完了温度 $T_{r,e}$ （たとえば60度C）以上であるかが判断され、 $T_{r,e} \leq T_e$ であったときには第4ステップS4に進む。

【0029】第4ステップS4では、図6(a)で示すマップによる検索が実行される。すなわち機関回転数 N_e および吸気圧力 P_s に基づいて、両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめるための二弁作動領域と、一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止せしめる一弁作動領域とが予め設定されており、検出された機関回転数 N_e および吸気圧力 P_s による図6(a)のマップに基づく検索が実行される。

【0030】次の第5ステップS5で一弁作動領域に在ると判断されたときには、第6ステップS6において、動弁装置18における連結切換機構41の油圧室47に油圧を作用させて、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23を連結解除状態とし、一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止させるようにする。また第5ステップS5で二弁作動領域であると判断されたときには、第7ステップS7において、前記連結切換機構41の油圧室47から油圧を解放させて、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23を連結状態とし、両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめるようにする。

【0031】第3ステップS3で、機関温度 T_e が暖機完了温度 $T_{r,e}$ 未満($T_e < T_{r,e}$)であると判断されたときには、第3ステップS3から第8ステップS8に進む。この第8ステップS8では、図6(b)で示すマップによる検索が実行される。すなわち機関回転数 N_e および吸気圧力 P_s に基づいて、両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめるための二弁作動領域と、一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止せしめる一弁作動領域とが予め設定されるが、この図6(b)で示すマップにおける二弁作動領域は、鎖線で示す図6(a)のマップに比べて、高負荷側において機関回転数 N_e および吸気圧力 P_s のいずれもが低くなる側に拡大されて設定されている。

【0032】第9ステップS9で、図6(b)のマップ検索により一弁作動領域に在ると判断されたときには、第10ステップS10に進み、動弁装置18における連結切換機構41の油圧室47に油圧を作用させて、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23を連結解除状態とし、一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止させるようにする。また第9ステップS9で二弁作動領域であると判断されたときには、第7ステップS7に進み、前記連結切換機構41の油圧室47から油圧を解放させて、第1駆動ロッカアーム21、自由ロッカアーム22および第2駆動ロッカアーム23を連結状態とし、両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめるようにする。

【0033】次にこの実施例の作用について説明すると、制御手段60は、機関負荷を代表する吸気圧力 P_s および機関回転数 N_e に基づいて二弁作動領域に在ると判断したときには両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめ、一弁作動領域では一方の吸気弁 V_{11} を開閉作動せしめるとともに他方の吸気弁 V_{12} を実質的に休止させるように動弁装置18の作動を制御するが、前記他方の吸気弁 V_{12} を実質的に休止させることにより燃焼室5内でスワール流を生じさせて希薄燃焼を行なうようにしたときに、暖機が完了する前の機関温度 T_e が低温である状態で特に機関負荷が高い場合には、層状給気に起因してスモークが発生する。しかるに、機関温度 T_e が暖機完了温度 $T_{r,e}$ 未満の状態での二弁作動領域は、図6(b)で示したように、図6(a)で示す暖機完了温度以上の状態に比べて、高負荷側において機関回転数 N_e および吸気圧力 P_s のいずれもが低くなる側に拡大されるものである。したがって暖機完了温度以上の状態では吸気弁 V_{11} を実質的に休止させる一弁作動を実行する高負荷時において、暖機完了温度未満の状態では、両吸気弁 V_{11} 、 V_{12} をともに開閉作動させることにより燃焼室5内では均質混合気が形成されることになり、スモークの発生が極力防止され、それにより機関耐久性の向上に寄与することができる。

【0034】しかも連結切換機構41は、油圧解放に応じて両吸気弁 V_{11} 、 V_{12} を開閉作動せしめ、油圧作用に応じて一方の吸気弁 V_{11} を開閉作動せしめるが他方の吸気弁 V_{12} を実質的に休止させるようにするものであり、切換応答性の上で問題が生じる極低油温時でも、両吸気弁 V_{11} 、 V_{12} をともに開閉作動せしめて高出力を得ることが可能となる。

【0035】以上、本発明の実施例を詳述したが、本発明は上記実施例に限定されるものではなく、特許請求の範囲に記載された本発明を逸脱することなく種々の設計変更を行なうことが可能である。

【0036】たとえば、二弁作動領域および一弁作動領域は、機関回転数および機関負荷の少なくとも一方に基

づいて設定されるものであればよい。また上記実施例では、吸気弁 V_{11} を完全には休止させず、一方の吸気弁 V_{11} が開弁するときには開弁方向にわずかに作動させるようにしたが、前記吸気弁 V_{11} を完全に休止させるようにしたものに関しても本発明を適用することができる。

【0037】

【発明の効果】 以上のように請求項1記載の発明に従う内燃機関は、機関回転数および機関負荷の少なくとも一方に基づいて設定される二弁作動領域では両吸気弁とともに開閉作動せしめるが前記二弁作動領域以外の一弁作動領域では一方の吸気弁を開閉作動せしめるとともに他方の吸気弁を実質的に休止させるようにして動弁装置の作動を制御する制御手段を備え、機関温度が暖機完了温度未満の状態での前記二弁作動領域は、暖機完了温度以上の状態に比べて前記機関回転数および機関負荷の少なくとも一方が低くなる側に拡大されて設定されるので、暖機完了温度以上のときには一弁を休止させる状態であっても、暖機完了温度未満では一対の吸気弁とともに開閉作動させるようにして均質混合気を得ることによりスモークの発生を極力防止し、機関耐久性の向上に寄与することができ

【0038】 また請求項2記載の発明によれば、上記請求項1記載の発明の構成に加えて、動弁装置は、両吸気

弁にそれぞれ個別に連動、連結される駆動ロッカアームを含む複数のロッカアームと、油圧解放に応じてそれらのロッカアームを連結して両吸気弁を開閉作動せしめる連結状態ならびに油圧作用に応じて前記ロッカアームの連結状態を解除して一方の吸気弁を開閉作動せしめるが他方の吸気弁を実質的に休止させる連結解除状態を切換可能な連結切換機構とを備えるものであり、切換応答性の上で問題が生じる極低油温時でも、両吸気弁とともに開閉作動せしめて高出力を得ることが可能となる。

【図面の簡単な説明】

【図1】 全体構成図である。

【図2】 動弁装置を示す拡大縦断面図である。

【図3】 図2の3-3線矢視図である。

【図4】 図3の4-4線断面図である。

【図5】 動弁装置の制御手順を示すフローチャートである。

【図6】 弁作動領域マップを示す図である。

【符号の説明】

18・・・動弁装置

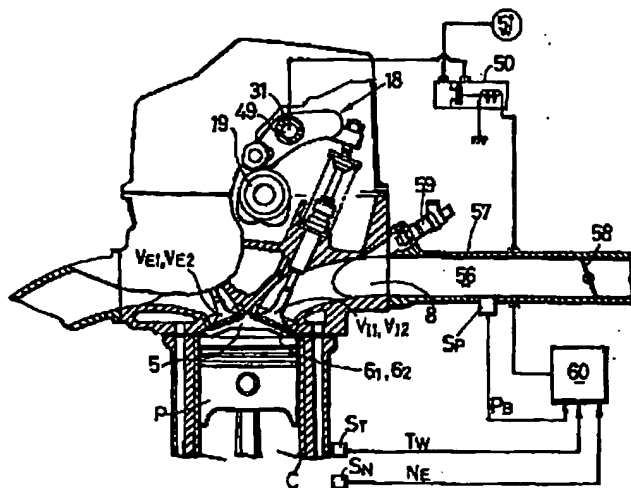
21, 22, 23・・・ロッカアーム

41・・・連結切換機構

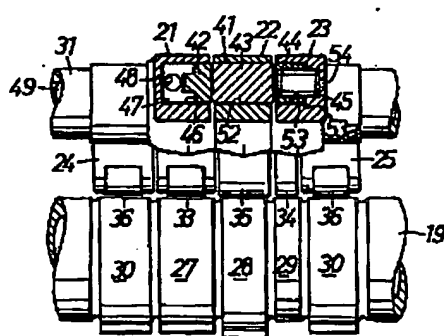
60・・・制御手段

V_{11} , V_{12} ・・・吸気弁

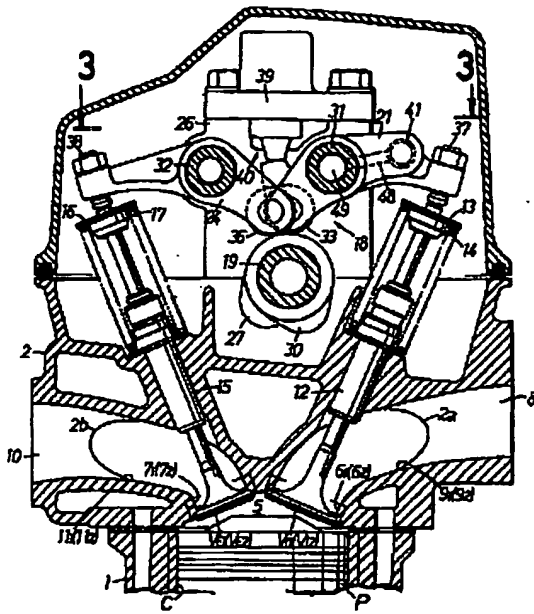
【図1】



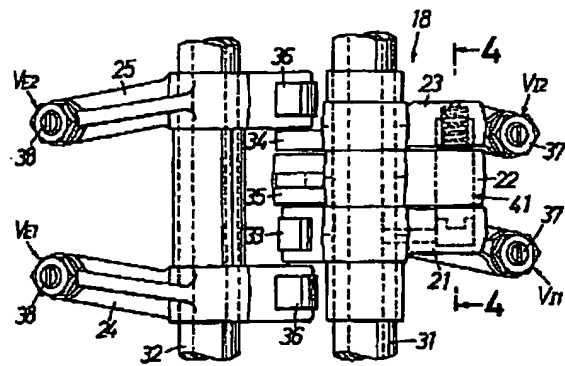
【図4】



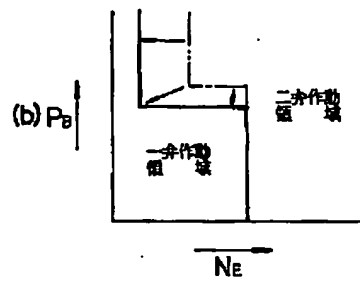
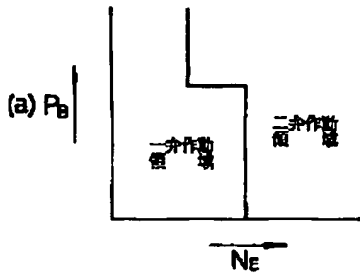
【図2】



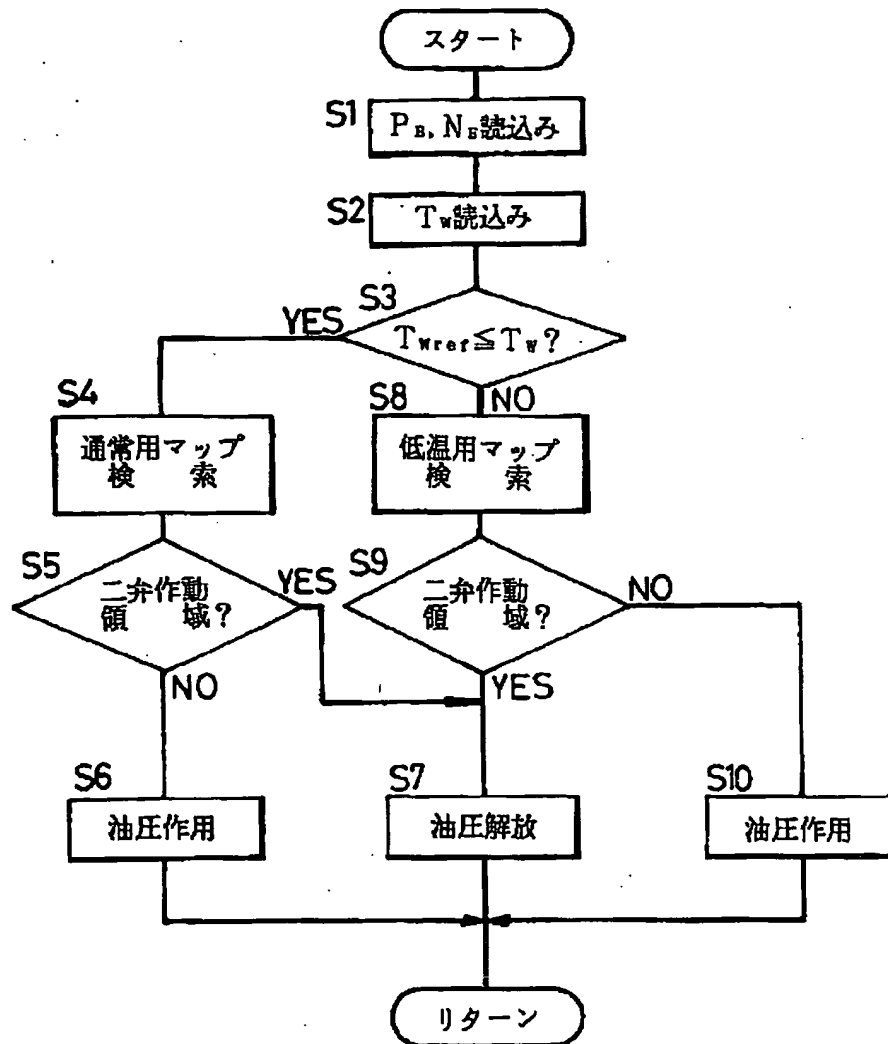
【図3】



【図6】



【図5】



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CLAIMS

[Claim(s)]

[Claim 1] The condition of carrying out closing motion actuation of both the inlet valves (VI1, VI2) of a couple, In the internal combustion engine which has a switchable moving valve mechanism (18) for the condition of stopping another side (VI2) substantially although both inlet valves (VI1, VI2) carry out closing motion actuation on the other hand (VI1) Although closing motion actuation of both the inlet valves (VI1, VI2) is carried out in both the 2 valve operating spaces set up based on either [at least] an engine rotational frequency or an engine load, while carrying out closing motion actuation of one inlet valve (VI1) in 1 valve operating spaces other than said 2 valve operating space It has the control means (60) which controls actuation of a moving valve mechanism (18) as is made to stop the inlet valve (VI2) of another side substantially. For said 2 valve operating space in the condition of under the completion temperature of warming-up, engine temperature is the internal combustion engine with which it is characterized by expanding and setting either [at least] said engine rotational frequency or an engine load to the side which becomes low compared with the condition beyond the completion temperature of warming-up.

[Claim 2] Two or more rocker arms containing the rocker arm (21 23) which said moving valve mechanism (18) is interlocked with both inlet valves (VI1, VI2) according to an individual, respectively, and is connected (21, 22, 23), According to oil pressure release, those rocker arms (21, 22, 23) are connected. According to the connection condition and oil pressure operation which carry out closing motion actuation of both the inlet valves (VI1, VI2), the connection condition of said rocker arm (21, 22, 23) is canceled. The internal combustion engine according to claim 1 characterized by having a switchable connection change-over device (41) for the deconcatenation condition of stopping the inlet valve (VI2) of another side substantially although closing motion actuation of one inlet valve (VI1) is carried out.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] Both this inventions relate the condition of carrying out closing motion actuation of the inlet valve of a couple, and the condition of stopping another side substantially although closing motion actuation of one side of both inlet valves is carried out to the internal combustion engine having a switchable moving valve mechanism.

[0002]

[Description of the Prior Art] Conventionally, this internal combustion engine is already known by JP,4-203454,A etc.

[0003]

[Problem(s) to be Solved by the Invention] By the way, although it can produce and cheat out of a swirl style to the combustion chamber of an engine body and lean combustion can be made possible if another side is changed into the condition of making it stopping substantially, although closing motion actuation of one side is carried out among the inlet valves of a couple It becomes deep and becomes the so-called stratified charge as the fuel concentration distribution by the combustion chamber goes to the method side of the outside of radial by this swirl style, and when engine temperature is low temperature, and especially an engine load is expensive, a smoke occurs. This smoke causes degradation of an engine lubricating oil, formation of the carbon deposit of the piston clevis section, and a piston ring stick, and it not only gives sensuous displeasure, like there is an exhaust air smell, but becomes the factor which spoils engine endurance. However, in the above-mentioned conventional thing, irrespective of engine temperature, based on the engine rotational frequency and the engine load, the boundary value of a 2 valve operating space and a 1 valve operating space is defined uniformly, and generating of a smoke cannot be prevented.

[0004] This invention is made in view of this situation, and aims to let engine temperature offer the internal combustion engine which prevented smoked generating in the low-temperature condition of under warming-up temperature.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned object, invention according to claim 1 In the internal combustion engine which has a switchable moving valve mechanism for the condition of carrying out closing motion actuation of both the inlet valves of a couple, and the condition of stopping another side substantially although closing motion actuation of one side of both inlet valves is carried out Although closing motion actuation of both the inlet valves is carried out in both the 2 valve operating spaces set up based on either [at least] an engine rotational frequency or an engine load, while carrying out closing motion actuation of one inlet valve in 1 valve operating spaces other than said 2 valve operating space It has the control means which controls actuation of a moving valve mechanism as is made to stop the inlet valve of another side substantially. Engine temperature said 2 valve operating space in the condition of under the completion temperature of warming-up It is characterized by being expanded and set to the side to which either [at least] said engine rotational frequency or an engine load becomes low compared with the condition beyond the completion temperature of warming-up.

[0006] According to invention according to claim 2, in the configuration of invention of the claim 1 above-mentioned publication moreover, in addition, a moving valve mechanism Two or more rocker arms containing the actuation rocker arm which it interlocks according to an individual to both inlet valves, and is connected with them, respectively, The connection condition of said rocker arm is canceled according to the connection condition and oil pressure operation which those rocker arms are connected [operation] according to oil pressure release, and carry out closing motion actuation of both the inlet valves. Although closing motion actuation of one inlet valve is carried out, it has a

switchable connection change-over device for the deconcatenation condition of stopping the inlet valve of another side substantially.

[0007]

[Example] Hereafter, a drawing explains one example of this invention.

[0008] The enlarged vertical longitudinal sectional view in which drawing 1 thru/or drawing 6 show one example of this invention, drawing 1 shows a whole block diagram, and drawing 2 shows a moving valve mechanism, the flow chart with which in drawing 3 3-3 line view drawing of drawing 2 and drawing 4 show the 4-4 line sectional view of drawing 3, and drawing 5 shows the control procedure of a moving valve mechanism, and drawing 6 are drawings showing a valve operating-space map.

[0009] First, the cylinder head 2 is combined with the top face of a cylinder block 1, fitting of the sliding of Piston P is made possible to two or more cylinders C prepared in the cylinder block 1 in drawing 1 and drawing 2, respectively that the body of the engine body in a SOHC mold Taki cylinder internal combustion engine should be constituted, and a combustion chamber 5 is formed between the top face of those pistons P, and the cylinder head 2, respectively.

[0010] the head-lining side of a combustion chamber 5 -- opening -- carrying out -- making -- the inlet-valve opening 61 of a couple, and 62 The exhaust valve opening 71 of a couple, and 72 it prepares in the cylinder head 2 -- having -- **** -- both the inlet-valves opening 61 and 62 The inlet port 91 which inserted septum 2a into the single inhalation-of-air opening edge 8 which carries out opening to one side face of the cylinder head 2 mutually, and 92 It minds and stands in a row. Both the exhaust valve opening 71 and 72 The exhaust port 111 which inserted septum 2b into the single exhaust air opening edge 10 which carries out opening to the other side faces of the cylinder head 2 mutually, and 112 It minds and stands in a row. Moreover, both inlet-valves openings 61 and 62 The inlet valves VI1 and VI2 of the couple which can be opened and closed according to an individual Fitting of the sliding is made respectively possible to the guide cylinder 12 of the couple arranged by the cylinder head 2. Between the retainers 13 and the cylinder heads 2 which were fixed to the upper bed section of each inlet valves VI1 and VI2 which projected from each guide cylinder 12, respectively, the coiled form valve spring 14 which surrounds each inlet valves VI1 and VI2 is interposed, respectively. Each inlet valves VI1 and VI2 are energized in the upper part of clausilium, i.e., the direction, by those valve springs 14. Furthermore, it is both the exhaust valve opening 71 and 72. The exhaust valves VE1 and VE2 of the couple which can be opened and closed according to an individual Fitting of the sliding is made respectively possible to the guide cylinder 15 of the couple arranged by the cylinder head 2. Between the retainers 16 and the cylinder heads 2 which were fixed to the upper bed section of each exhaust valves VE1 and VE2 which projected from each guide cylinder 15, respectively, the coiled form valve spring 17 which surrounds each exhaust valves VE1 and VE2 is interposed, respectively. Each exhaust valves VE1 and VE2 are energized in the upper part of clausilium, i.e., the direction, by those valve springs 17.

[0011] Drawing 3 is referred to collectively and a moving valve mechanism 18 is connected with both the inlet valves VI1 and VI2 and both the exhaust valves VE1 and VE2. This moving valve mechanism 18 is equipped with the single cam shaft 19 which it interlocks and is connected with the crankshaft which is not illustrated with one half of reduction gear ratios, the 1st actuation rocker arm 21 for changing rotation of a cam shaft 19 into the opening and closing movement of both the inlet valves VI1 and VI2, the free rocker arm 22 and the 2nd actuation rocker arm 23, and the 1st and 2nd exhaust side rocker arms 24 and 25 for changing rotation of said cam shaft 19 into the opening and closing movement of both the exhaust valves VE1 and VE2.

[0012] A cam shaft 19 is with the cylinder head 2 and holder 26 -- combined on this cylinder head 2 on both sides of the cylinder 3 which meets the axis of said crankshaft, respectively, and it is supported free [a revolution], having the axis of a cylinder 3, and the level axis which intersects perpendicularly.

[0013] The 1st inspired air flow path cam 27 of the configuration on drawing 4 and corresponding to an engine's low r.p.m. operation in a cam shaft 19, While the 2nd inspired air flow path cam 28 by which contiguity arrangement is carried out at the 1 side of the 1st inspired air flow path cam 27, and the ridge 29 which adjoins the 1 side of the 2nd inspired air flow path cam 28 are formed in one, being formed in the configuration corresponding to high-speed operation of an engine The exhaust side cams 30 and 30 are formed in the both sides of the 1st inspired air flow path cam 27 and a ridge 29 at one. Although it is formed so that said ridge 29 may have the circular outside surface of both the inlet valves VI1 and VI2 centering on the axis of a cam shaft 19 fundamentally in an engine's low-load-driving region that VI2 should be substantially made hibernation on the other hand, the projected part which projected slightly is prepared in the location corresponding to the high order section of the 1st and 2nd inspired air flow path cams 27 and

28. And the width of face of this ridge 29 in the direction which meets the axis of a cam shaft 19 is set up comparatively narrowly.

[0014] The 1st actuation rocker arm 21 interlocks and is connected with one inlet valve VI 1, the 2nd actuation rocker arm 23 interlocks, and is connected with the inlet valve VI 2 of another side, and the free rocker arm 22 which can become free to both the inlet valves VI1 and VI2 is arranged between the 1st and 2nd actuation rocker arm 21 and 23. It **, and the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 are supported free [a splash] by the inspired air flow path rocker shaft 31 supported by holder 26 -- fixed, having an axis parallel to this cam shaft 19 in the slanting upper part location of a cam shaft 19. Moreover, according to the individual, the 1st and 2nd exhaust side rocker arms 24 and 25 interlock, are connected with both the exhaust valves VE1 and VE2, and are supported free [a splash] by the exhaust side rocker shaft 32 which carried out to said inspired air flow path rocker shaft 31 at parallel, and was supported by holder 26 -- fixed in the slanting upper part location of said cam shaft 19.

[0015] The roller 33 which carries out the rolling contact to the 1st inspired air flow path cam 27 is supported to revolve by the end of the 1st actuation rocker arm 21, while the slide contact section 34 which ****s at the end of the 2nd actuation rocker arm 23 at a ridge 29 narrows width of face corresponding to a ridge 29, it is prepared, and the CAMS rip saw 35 which ****s for the 2nd inspired air flow path cam 28 is formed in the free rocker arm 22. Moreover, the roller 36 which carries out the rolling contact to the exhaust side cams 30 and 30 prepared in the cam shaft 19 is supported to revolve by the end of both the exhaust side rocker arms 24 and 25, respectively.

[0016] The tappet screw thread 37 which contacts the upper bed of both the inlet valves VI1 and VI2 is screwed in the other end of the 1st and 2nd actuation rocker arms 21 and 23 respectively free [an attitude], and each inlet valves VI1 and VI2 will carry out closing motion actuation according to splash actuation of the 1st and 2nd actuation rocker arms 21 and 23. Moreover, the tappet screw thread 38 which contacts the upper bed of each exhaust valves VE1 and VE2 is screwed in the other end of both the exhaust side rocker arms 24 and 25 respectively free [an attitude], and each exhaust valves VE1 and VE2 will carry out closing motion actuation according to splash actuation of both the exhaust side rocker arms 24 and 25.

[0017] By the way, the support plate 39 is constructed between upper beds, and the from-cartridge-energized lost motion device 40 is arranged in the direction of each holder 26 -- which makes the free rocker arm 22 **** for the 2nd inspired air flow path cam 28 of a cam shaft 19 by this support plate 39.

[0018] The connection condition of those rocker arms 21-23 and the deconcatenation condition of those rocker arms 21-23 are prepared in the switchable connection change-over device 41 by the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 according to an engine's operational status.

[0019] This connection change-over device 41 is equipped with the change-over piston 42 fitting of the sliding of is made possible to the 1st actuation rocker arm 21, the 1st connection pin 43 which can connect the 1st actuation rocker arm 21 and the free rocker arm 22, the 2nd connection pin 44 which can connect the free rocker arm 22 and the 2nd actuation rocker arm 23, and the spring 45 ****(ed) between the 2nd connection pin 44 and the 2nd actuation rocker arm 23.

[0020] The 1st guide hole 46 of the owner bottom opened to the free rocker arm 22 side is drilled in the inspired air flow path rocker shaft 31 and parallel by the 1st actuation rocker arm 21, fitting of the sliding of the change-over piston 42 is made possible to it in this 1st guide hole 46, and the oil pressure room 47 is formed between the end of the change-over piston 42, and the lock out edge of the 1st guide hole 46. Moreover, the free passage way 48 which is open for free passage in the oil pressure room 47 is drilled by the 1st driving-side rocker arm 21, and the oilway 49 which is always open for free passage on said free passage way 48 47, i.e., an oil pressure room, is formed irrespective of the splash condition of the 1st actuation rocker arm 21 in the inspired air flow path rocker shaft 31. It **, and this oilway 49 is connected to a hydraulic power unit 51 through the electromagnetic-control valve 50 for a connection change-over, as drawing 1 shows.

[0021] The guide hole 52 corresponding to the 1st guide hole 46 carries out to the inspired air flow path rocker shaft 31 at parallel, and is drilled over the both-sides side by the free rocker arm 22, and fitting of the sliding of the 1st connection pin 43 by which an end is contacted by the other end of said change-over piston 42 is made possible to the guide hole 52.

[0022] In the 2nd actuation rocker arm 23, have step 53a which attends the free rocker arm 22 side while the 2nd guide hole 53 of the owner bottom corresponding to said guide hole 52 opens to the free rocker arm 22 side, and the inspired air flow path rocker shaft 31 and parallel are punctured. The 2nd connection pin 44 of the shape of a closed-end

cylinder which made the end contact the other end of the 1st connection pin 43 may make, as the other end contacts said step 53a, and fitting of the sliding of the 2nd guide hole 53 of it is made possible to it. This 2nd connection pin 44 turns that opening edge to lock out one end of the 2nd guide hole 53, and is arranged, and a spring 45 is ****(ed) between the lock out edge of the 2nd guide hole 53, and the lock out edge of the 2nd connection pin 44. And air and the free passage hole 54 for an oil removing are drilled in the lock out edge of the 2nd guide hole 53.

[0023] In this connection change-over device 41, if oil pressure is made to act on the oil pressure room 47 by the electromagnetic-control valve 50 for a connection change-over, the change-over piston 42 will move to the side which resists the spring force of a spring 45 and increases the volume of the oil pressure room 47, and when the 2nd connection pin 44 contacts step 53a, a migration edge will be regulated. In this condition, the contact side of the change-over piston 42 and the 1st connection pin 43 is located in the location corresponding to between the 1st actuation rocker arm 21 and the free rocker arm 22, and the contact side of the 1st connection pin 43 and the 2nd connection pin 44 is located in the location corresponding to between the free rocker arm 22 and the 2nd actuation rocker arm 23. Therefore, it is in the condition in which relative angular displacement is possible mutually, splash actuation of the 1st actuation rocker arm 21 is carried out by the 1st inspired air flow path cam 27 by revolution actuation of a cam shaft 19, and the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 carry out closing motion actuation of one inlet valve VI 1 in the timing according to a configuration and the amount of lifts of the 1st inspired air flow path cam 27. Moreover, the 2nd actuation rocker arm 23 which ****ed to the ridge 29 can be in hibernation substantially, and can stop the inlet valve VI 2 of another side substantially. And since it operates slightly in the valve-opening direction when an inlet valve VI 2 is not stopped thoroughly but one inlet valve VI 1 opens, fixing to the valve seat of the inlet valve VI 2 produced when a perfect clausilium condition is maintained, and stagnation of a fuel can be prevented. Although splash actuation of the free rocker arm 22 is furthermore carried out by the 2nd inspired air flow path cam 28, no effect also exerts the splash actuation on the 1st and 2nd actuation rocker arms 21 and 23. Moreover, exhaust valves VE1 and VE2 carry out closing motion actuation in the timing according to a configuration and the amount of lifts of the exhaust side cams 30 and 30.

[0024] When the oil pressure of the oil pressure room 47 was released by the electromagnetic-control valve 50 for a connection change-over and the axis of the 1st guide hole 46, the guide hole 52, and the 2nd guide hole 53 is in agreement, according to the spring force of a spring 45, the 2nd connection pin 44 fits into the guide hole 52, pressing the 1st connection pin 43, and the 1st connection pin 43 fits into the 1st guide hole 46, pressing the change-over piston 42. The 1st connection pin 43 will connect the 1st actuation rocker arm 21 and the free rocker arm 22 in the condition that *(ed) and the change-over piston 42 had migration regulated by the lock out edge of the 1st guide hole 46, and the 2nd connection pin 44 will connect the free rocker arm 22 and the 2nd actuation rocker arm 23. By this, the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 will be in a connection condition, the 1st and 2nd actuation rocker arms 21 and 23 rock with the free rocker arm 22 in which splash actuation is carried out by the 2nd inspired air flow path cam 28, and both the inlet valves VI1 and VI2 both carry out closing motion actuation in the timing according to a configuration and the amount of lifts of the 2nd inspired air flow path cam 28. Moreover, both the exhaust side rocker arms 24 and 25 carry out closing motion actuation of both the exhaust valves VE1 and VE2 like the time of a low load in the timing and the amount of lifts according to a configuration of the exhaust side cams 30 and 30.

[0025] Namely, the connection condition of the connection change-over device 41 connecting the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 according to oil pressure release, and carrying out closing motion actuation of both the inlet valves VI1 and VI2, Although the connection condition of the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 is canceled according to an oil pressure operation and closing motion actuation of one inlet valve VI 1 is carried out, the deconcatenation condition of stopping the inlet valve VI 2 of another side substantially is constituted switchable.

[0026] In drawing 1, the inlet pipe 57 which forms the inhalation-of-air path 56 is again connected to the inhalation-of-air opening edge 8, and a throttle valve 58 is interposed while being this inhalation-of-air path 56. Moreover, in the edge by the side of the cylinder head 2 in an inlet pipe 57, it is the inhalation-of-air opening edge 8 to both the inlet-valves opening 61, and 62. The fuel injection valve 59 which turns and injects a fuel is attached.

[0027] Actuation of said electromagnetic-control valve 50 for a connection change-over for switching the operating state of a moving valve mechanism 18 It is what is controlled by the control means 60 which consists of a computer. To this control means 60 MAP PB as an index representing an engine load The MAP sensor SP and the engine rotational

frequency NE to detect Rotational frequency sensor SN to detect The engine rotational frequency NE detected and engine temperature TW Engine temperature sensor ST to detect It connects, respectively.

[0028] In order to ** and to control actuation of the electromagnetic-control valve 50 for a connection change-over, i.e., change-over actuation of a moving valve mechanism 18 When it explains referring to drawing 5 about the control procedure set up by the control means 60, at the 1st step S1 and the 2nd step S2 MAP PB and engine rotational frequency NE And engine temperature TW the 3rd step S3 after reading -- engine temperature TW whether it is beyond the completion temperature TWref of warming-up (for example, 60 degrees C) judges -- having -- TWref<=TW it was -- sometimes, it progresses at the 4th step S4.

[0029] In the 4th step S4, a search on the map shown by drawing 6 (a) is performed. Namely, engine rotational frequency NE And MAP PB The 2 valve operating space for being based and carrying out closing motion actuation of both the inlet valves VI1 and VI2 of both, Engine rotational frequency NE which the 1 valve operating space which makes the inlet valve VI 2 of another side stop substantially is beforehand set up although closing motion actuation of one inlet valve VI 1 is carried out, and was detected And MAP PB A search based on the map of drawing 6 (a) to twist is performed.

[0030] When it is judged that it is in a 1 valve operating space at the 5th following step S5 Oil pressure is made to act on the oil pressure room 47 of the connection change-over device 41 in a moving valve mechanism 18 in the 6th step S6. Although the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 are made into a deconcatenation condition and closing motion actuation of one inlet valve VI 1 is carried out, it is made to stop the inlet valve VI 2 of another side substantially. Moreover, when it is judged at the 5th step S5 that it is a 2 valve operating space, in the 7th step S7, oil pressure is made to release from the oil pressure room 47 of said connection change-over device 41, the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 are made into a connection condition, and it is made to carry out closing motion actuation of both the inlet valves VI1 and VI2 of both.

[0031] At the 3rd step S3, it is the engine temperature TW. When it is judged that it is under the completion temperature TWref of warming-up ($TW < TW_{ref}$), it progresses to the 8th step S8 from the 3rd step S3. At this 8th step S8, a search on the map shown by drawing 6 (b) is performed. Namely, engine rotational frequency NE And MAP PB Although the 2 valve operating space for being based and carrying out closing motion actuation of both the inlet valves VI1 and VI2 of both and the 1 valve operating space which makes the inlet valve VI 2 of another side stop substantially although closing motion actuation of one inlet valve VI 1 is carried out are set up beforehand the map of drawing 6 (a) in which the 2 valve operating space in the map shown by this drawing 6 (b) is shown with the chain line -- comparing -- a heavy load side -- setting -- engine rotational frequency NE And MAP PB any -- although -- it is expanded and set to the side which becomes low.

[0032] When it is judged by the 9th step S9 that it is in a 1 valve operating space by map retrieval of drawing 6 (b) Progress to the 10th step S10 and oil pressure is made to act on the oil pressure room 47 of the connection change-over device 41 in a moving valve mechanism 18. Although the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 are made into a deconcatenation condition and closing motion actuation of one inlet valve VI 1 is carried out, it is made to stop the inlet valve VI 2 of another side substantially. Moreover, when it is judged that it is a 2 valve operating space in the 9th step S9, progress to the 7th step S7, oil pressure is made to release from the oil pressure room 47 of said connection change-over device 41, the 1st actuation rocker arm 21, the free rocker arm 22, and the 2nd actuation rocker arm 23 are made into a connection condition, and it is made to carry out closing motion actuation of both the inlet valves VI1 and VI2 of both.

[0033] When an operation of this example is explained, next, a control means 60 MAP PB representing an engine load And engine rotational frequency NE Are based, and when [both] it judges that it is in a 2 valve operating space, closing motion actuation of both the inlet valves VI1 and VI2 is carried out. Although actuation of a moving valve mechanism 18 is controlled by the 1 valve operating space to stop the inlet valve VI 2 of another side substantially while carrying out closing motion actuation of one inlet valve VI 1 Engine temperature TW when a swirl style is produced in a combustion chamber 5 and it is made to perform lean combustion by stopping substantially the inlet valve VI 2 of said another side, before warming up is completed In the condition of being low temperature, when especially an engine load is expensive, it originates in stratified charge and a smoke occurs. however, engine temperature TW the condition beyond the completion temperature of warming-up shown by drawing 6 (a) as drawing 6 (b) showed the 2 valve operating space in the condition of under the completion temperature TWref of warming-up --

comparing -- a heavy load side -- setting -- engine rotational frequency NE And MAP PB any -- although -- it is expanded to the side which becomes low. therefore, the thing done in both the condition of under the completion temperature of warming-up for the closing motion actuation of both the inlet valves VI1 and VI2 at the time of the heavy load which performs one valve action which carries out the real pause of the inlet valve VI 2 in the condition beyond the completion temperature of warming-up -- the inside of a combustion chamber 5 -- homogeneity -- gaseous mixture will be formed, generating of a smoke is prevented as much as possible, and, thereby, it can contribute to improvement in engine endurance.

[0034] And it becomes that it is made to stop the inlet valve VI 2 of another side substantially although closing motion actuation of both the inlet valves VI1 and VI2 is carried out according to oil pressure release and closing motion actuation of one inlet valve VI 1 is carried out according to an oil pressure operation, and closing motion actuation of both the inlet valves VI1 and VI2 of both is carried out also in the time of the super-low oil temperature which a problem produces on change-over responsibility, and the connection change-over device 41 can obtain high power.

[0035] As mentioned above, although the example of this invention was explained in full detail, this invention can perform various design changes, without deviating from this invention which is not limited to the above-mentioned example and indicated by the claim.

[0036] For example, a 2 valve operating space and a 1 valve operating space should just be set up based on either [at least] an engine rotational frequency or an engine load. Moreover, although it was made to make it operate in the valve-opening direction slightly in the above-mentioned example when an inlet valve VI 2 was not stopped thoroughly and one inlet valve VI 1 opened, this invention is applicable also about the thing it was made to stop said inlet valve VI 2 thoroughly.

[0037]

[Effect of the Invention] The internal combustion engine which follows invention according to claim 1 as mentioned above Although closing motion actuation of both the inlet valves is carried out in both the 2 valve operating spaces set up based on either [at least] an engine rotational frequency or an engine load, while carrying out closing motion actuation of one inlet valve in 1 valve operating spaces other than said 2 valve operating space It has the control means which controls actuation of a moving valve mechanism as is made to stop the inlet valve of another side substantially. Engine temperature said 2 valve operating space in the condition of under the completion temperature of warming-up Since either [at least] said engine rotational frequency or an engine load is expanded and set to the side which becomes low compared with the condition beyond the completion temperature of warming-up even if it is in the condition of stopping one valve at the time beyond the completion temperature of warming-up, closing motion actuation of the inlet valve of a couple is carried out under at both the completion temperature of warming-up -- making -- making -- homogeneity -- by obtaining gaseous mixture, generating of a smoke can be prevented as much as possible, and it can contribute to improvement in engine endurance.

[0038] According to invention according to claim 2, in the configuration of invention of the claim 1 above-mentioned publication moreover, in addition, a moving valve mechanism Two or more rocker arms containing the actuation rocker arm which it interlocks according to an individual to both inlet valves, and is connected with them, respectively, The connection condition of said rocker arm is canceled according to the connection condition and oil pressure operation which those rocker arms are connected [operation] according to oil pressure release, and carry out closing motion actuation of both the inlet valves. Although closing motion actuation of one inlet valve is carried out, it becomes possible to carry out closing motion actuation of both the inlet valves of both, and to obtain high power also in the time of the super-low oil temperature from which it has a switchable connection change-over device, and a problem produces the deconcatenation condition of stopping the inlet valve of another side substantially, on change-over responsibility.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is a whole block diagram.

[Drawing 2] It is the enlarged vertical longitudinal sectional view showing a moving valve mechanism.

[Drawing 3] It is 3-3 line view drawing of drawing 2 .

[Drawing 4] It is the 4-4 line sectional view of drawing 3 .

[Drawing 5] It is the flow chart which shows the control procedure of a moving valve mechanism.

[Drawing 6] It is drawing showing a valve operating-space map.

[Description of Notations]

18 ... Moving valve mechanism

21, 22, 23 ... Rocker arm

41 ... Connection change-over device

60 ... Control means

VI1, VI2 ... Inlet valve

[Translation done.]

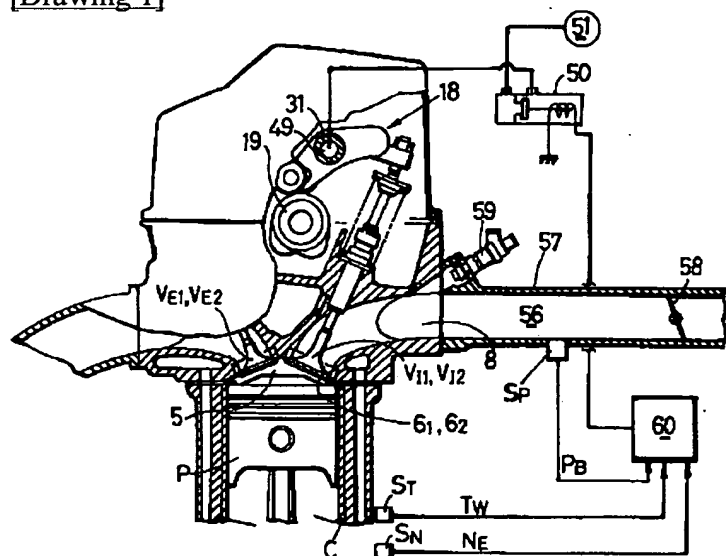
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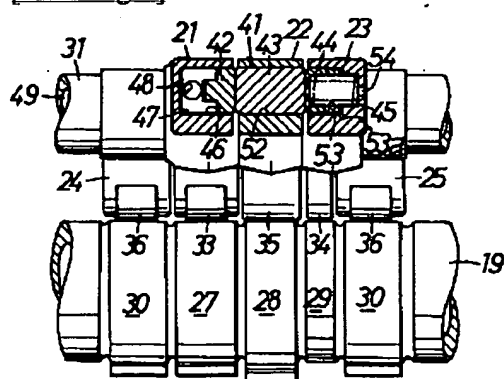
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DRAWINGS

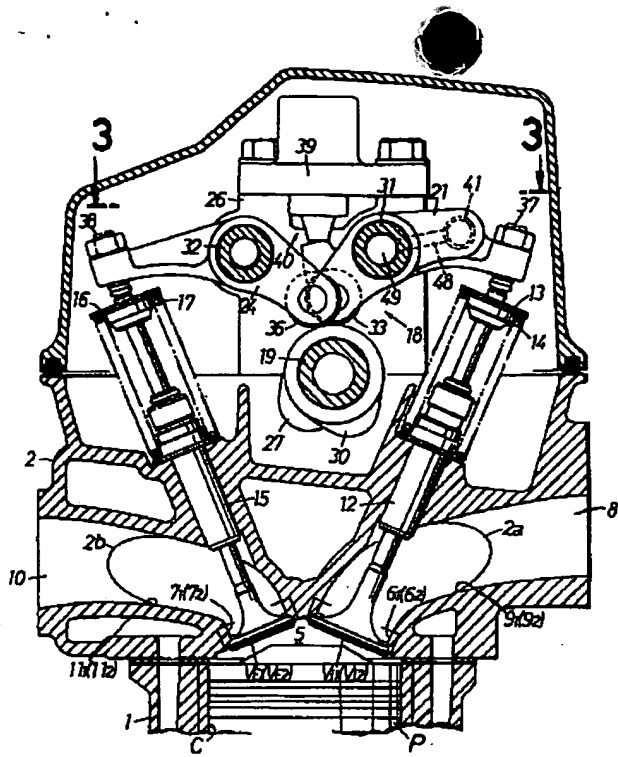
[Drawing 1]



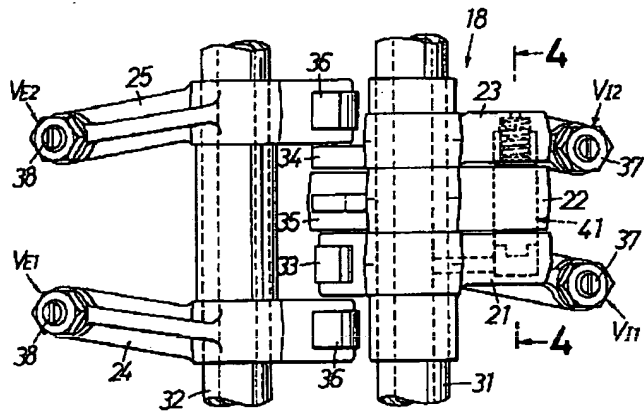
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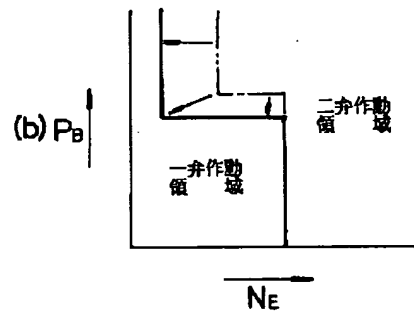
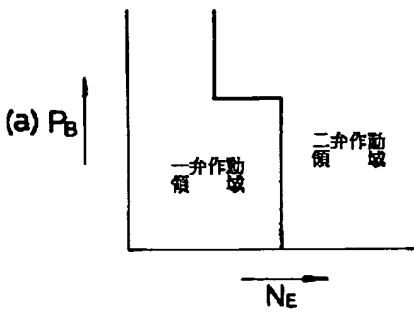
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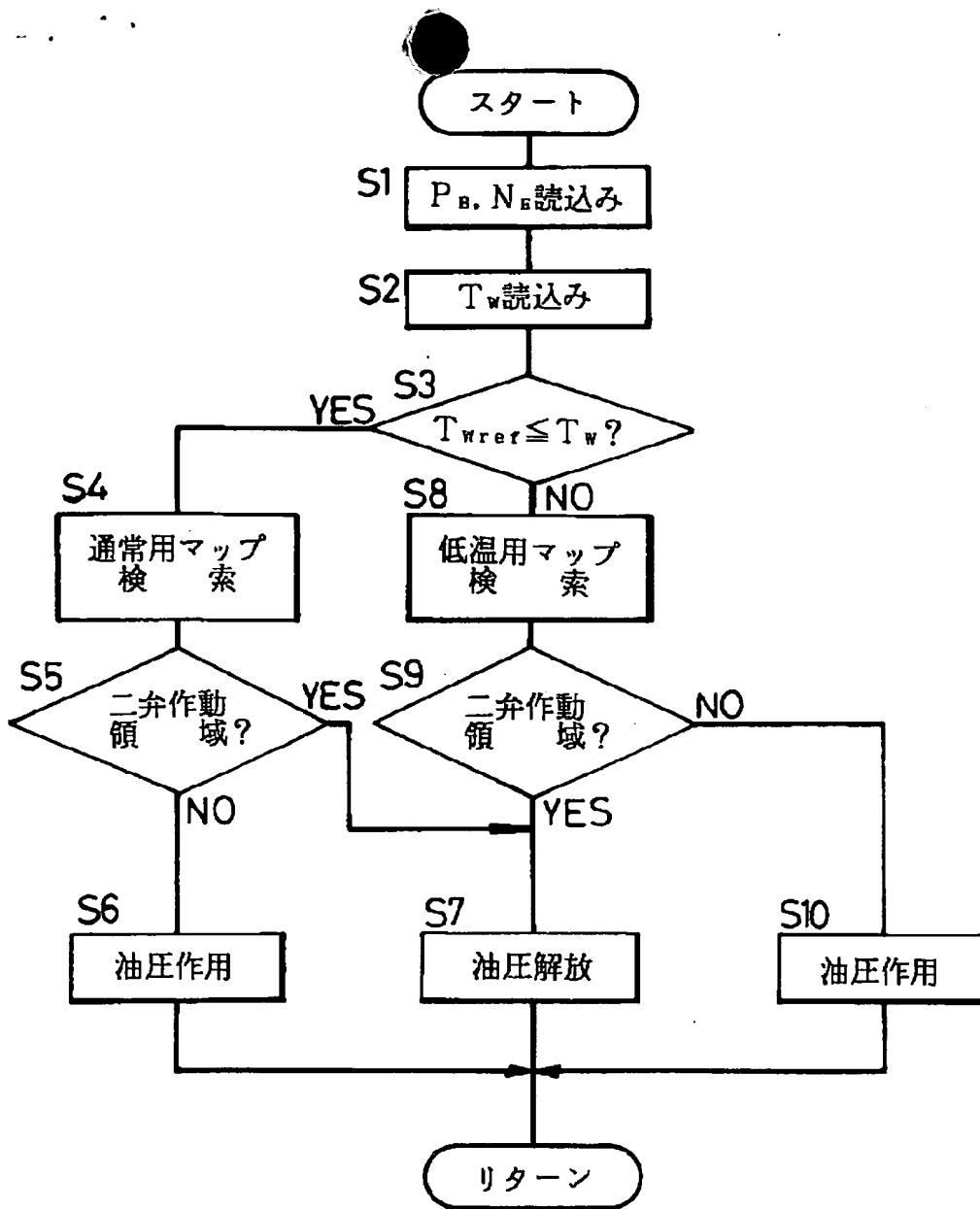
[Drawing 3]



[Drawing 6]



[Drawing 5]



[Translation done.]